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**Rule CIC331:** High percent LRU activity in the TS queue index buffer pool

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**Finding:** The CICS Shared Temporary Storage Queue Server statistics showed that there was a high percent of requests that discarded and reused the oldest valid buffer using the Least Recently Used (LRU) algorithm in the shared temporary storage queue index buffer pool.

**Impact:** This finding has a LOW IMPACT or MEDIUM IMPACT on the performance of the CICS region.

**Logic flow:** This is a basic finding, based on an analysis of the data. The finding applies only with CICS/Transaction Server for OS/390 or for z/OS.

**Discussion:** The shared temporary storage queue server uses a *queue index buffer pool* within its region, to read and write queue index entries. When a READQ TS or WRITEQ TS request completes, the queue index information is retained in the buffer. Retaining the queue index entries in the queue index buffer pool can avoid the need to reread the queue index entry if the same queue is referenced from the same MVS image before the buffer has been reused.

The queue index buffer pool holds recently accessed index entries in storage to reduce significantly the coupling facility I/O for queue items. It is much more efficient to reuse an entry in the queue index buffer pool than to request the information for the coupling facility.

The queue index buffer pool is used for data associated with queue index entries if the total queue size does not exceed 32K bytes (that is, the TS queue is a "small queue").

When a request for the same queue arrives, the shared TS queue server determines whether the queue index information is in the buffer. If the information is in the buffer, a coupling facility access is avoided. When the request completes, the shared TS queue server places the information into a buffer, onto a least recently used (LRU) chain. If all other buffers are in use, a request for a new buffer will discard the contents of the least recently used buffer and reuse the storage as a free buffer.

There is nothing intrinsically wrong with the shared TS queue server discarding the contents of the least recently used buffer. This is how the algorithms are designed. However, if a buffer is required from the LRU chain, this means that all other buffers were in use. If all other buffers were in use, it is possible that (1) an inadequate number of buffers were defined

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or (2) the application is not freeing buffers in a timely manner. In either case, a large percent of LRU activity could imply “thrashing” in the queue index buffer pool.

Shared temporary storage queue server buffer pool statistics available in MXG file CICXQ2. CPEXpert uses data in CICXQ2 to calculate the percent LRU activity, using the following algorithm:

$$\text{Percent LRU activity} = \frac{S2BFGLRS}{S2BFGETS + S2BFPUTS}$$

where    S2BFGLRS = Requests that discarded and reused oldest valid buffer  
          S2BFGETS = Requests to read a buffer  
          S2BFPUTS = Requests to write a buffer

CPEXpert produces Rule CIC331 when the percent LRU activity is greater than the value specified by the **TSPCTLRU** guidance variable in USOURCE(CICGUIDE). The default value for the **TSPCTLRU** is 0.1, indicating that CPEXpert should produce Rule CIC331 whenever the percent LRU activity is greater than 0.1% of the queue index buffer pool requests. This low percent LRU activity was set as a default to alert you to a potential problem that requires attention.

**Suggestion:** If this finding is consistently produced, you should consider the following alternatives:

- Review the output from CIC331 over several days to determine whether the percent LRU activity is small and relatively stable. If so, you may wish change the TSPCTLRU guidance variable in USOURCE(CICGUIDE), so Rule CIC331 is produced only when you wish to make a change in the number of buffers. Increasing the guidance percent normally would be done only if you have discovered that the use of buffers is an expected result of application activity.
- Use the BUFFERS primary parameter for the queue server region, to increase the number of buffers specified for the queue index buffer pool. This action would particularly be appropriate if the finding shows an **increasing** number of requests that discarded and reused the oldest valid buffer.
- Review applications using shared temporary storage to determine whether the applications are freeing temporary storage buffer pool buffers in a timely manner.

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- Change the TSPCTLRU guidance variable in USOURCE(CICGUIDE) so Rule CIC331 is produced only when you wish to be aware of a larger percent of LRU activity in the queue index buffer pool.
  - You can specify **%LET TSPCTLRU = 100;** in USOURCE(CICGUIDE) to suppress this finding (the percent LRU activity cannot be greater than 100%), or you can “turn off” the rule using the process described in Section 3 of this User Manual. This alternative is NOT recommended, since you should normally be aware of potential “thrashing” in the queue index buffer pool.

**Reference:** *CICS/TS Release 1.1*

*CICS System Definition Guide:* Section 3.4.3.4: Primary parameters

*CICS Performance Guide:* Shared TS queue server: buffer pool statistics

*CICS/TS Release 1.2*

*CICS System Definition Guide:* Section 3.4.3.4: Primary parameters

*CICS Performance Guide:* Shared TS queue server: buffer pool statistics

*CICS/TS Release 1.3*

*CICS System Definition Guide:* Section 4.2.2.4: Primary parameters

*CICS Performance Guide:* Shared TS queue server: buffer pool statistics

CICS/TS for z/OS Release 2.1

*CICS System Definition Guide:* Chapter 21: Primary parameters

*CICS Performance Guide:* Shared TS queue server: buffer pool statistics

CICS/TS for z/OS Release 2.2

*CICS System Definition Guide:* Chapter 21: Primary parameters

*CICS Performance Guide:* Shared TS queue server: buffer pool statistics